PATERSON GROUP

memorandum

re: **Slope Stability & Global Stability Analyses**
Proposed Multi-Storey Building
83-91 Sweetland Avenue – Ottawa, Ontario

to: Upscale Homes – **Mr. Alfred Abboud** – alfredabboud@gmail.com

date: April 7, 2025

file: PG7100-MEMO.01

Further to your request and authorization, Paterson Group (Paterson) prepared the current memorandum to provide the results of the slope stability and global stability analyses for the proposed building and retaining wall structures, respectively, to be located at the aforementioned site. The site location is shown on the attached Figure 1 – Key Plan.

The following drawing was reviewed as part of the slope stability & global stability analyses:

- Proposed Grading Plan, 83-91 Sweetland Avenue – Job No. 24123 – Drawing No. C – 3 of 4 Revision 2, dated February 19, 2025 and prepared by D.B Gray Engineering Inc.

The following sections provide a summary of the slope stability and global stability analyses, and our associated conclusions.

1.0 Proposed Development

Based on our review of the drawings provided by the client, it is understood that the proposed development will consist of a 4-storey apartment building with a basement level, founded on conventional spread footings. Additionally, retaining walls with heights greater than 1 meter are proposed at the north, east, and southern boundaries of the subject site.

It is understood that the existing residential dwellings will be demolished to allow construction of the proposed residential dwelling. The proposed building is expected to be municipally serviced.

2.0 Field Observations

Surface Conditions

The subject site comprises 5 contiguous properties aligned in a north-south orientation. It is currently occupied by residential dwellings, along with associated at-grade parking and landscaped areas. The ground surface slopes gently downward from north to south, with geodetic elevations ranging from approximately 63 m to 61 m.

Subsurface Conditions

Based on the geotechnical investigation completed by Paterson in May 2024, and available geological mapping, the subsurface conditions within the depth of excavation at the subject site are anticipated to consist of topsoil and/or fill underlain by a hard to stiff, brown silty clay crust, becoming a very stiff to stiff, grey silty clay at approximate depths of 4.5 to 5.2 m below the existing ground surface.

In the southern portion of the site, a glacial till deposit was encountered underlying the silty clay at an approximate depth of 5.5 m. The glacial till deposit was observed to consist of a compact to very dense, grey silty sand to sandy silt with gravel, cobbles, and boulders.

Furthermore, available geological mapping indicates that the bedrock within the area consists of shale of the Verulam Formation with an overburden drift thickness of 10 to 15 m in depth.

3.0 Global Stability Analysis

Three cross-sections have been analyzed for slope stability and global stability. The locations of the cross-sections are shown on the attached Drawing PG7100-1 – Site Plan.

The analysis of global stability was carried out using SLIDE, a computer program that permits a two-dimensional global stability analysis using several methods, including the Bishop's method, which is a widely used and accepted analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to those favouring failure. Theoretically, a factor of safety (FS) of 1.0 represents a condition where the structure is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsoil and groundwater conditions, a factor of safety greater than one is usually required to ascertain that the risks of failure are acceptable. A minimum factor of safety of 1.5 is generally recommended for static analysis conditions, and a minimum F.o.S of 1.1 is generally recommended for seismic analysis conditions.

Static Loading Analysis

The effective strength soil parameters used for static analysis were chosen based on our experience in the area and general values provided in the City of Ottawa's "Slope Stability Guidelines for Development Applications". The effective strength soil parameters used for static analysis are presented in Table 1 on the next page:

Table 1 – Effective Strength Soil and Material Parameters (Static Analysis)			
Soil Layer	**Unit Weight (kN/m^3)**	**Friction Angle (degrees)**	**Cohesion (kPa)**
Existing Fill	18	33	5
Brown Silty Clay	17	33	5
Grey Silty Clay	10	33	10
Glacial Till	20	33	0
Crushed Stone Fill	18	0	31
Topsoil	16	33	5

The results of the static loading analysis at Section A-A, Section B-B and Section C-C are shown on the attached Figure 2A, Figure 2C and Figure 2E. The factor of safety was found to exceed 1.5 under static conditions at these 3 cross-sections. Accordingly, the slope and retaining walls are considered to be stable under static loading.

Seismic Loading Analysis

The effective strength soil parameters used for static analysis were chosen based on our experience in the area and general values provided in the City of Ottawa's "Slope Stability Guidelines for Development Applications". A horizontal acceleration of 0.16g was applied for the retaining wall under seismic conditions. The strength soil parameters used for seismic analysis are presented in Table 2 below.

Table 2 – Total Strength Soil and Material Parameters (Seismic Analysis)			
Soil Layer	**Unit Weight (kN/m^3)**	**Friction Angle (degrees)**	**Cohesion (kPa)**
Existing Fill	18	33	5
Brown Silty Clay	17	-	100
Grey Silty Clay	10	-	60
Glacial Till	20	33	0
Crushed Stone Fill	18	0	31
Topsoil	16	33	5

The results of the seismic loading analysis at Section A-A, Section B-B, and Section C-C are shown on the attached Figure 2B, Figure 2D and Figure 2F. The factor of safety was found to exceed 1.1 under seismic conditions.

Accordingly, the proposed slope and retaining walls are considered to be stable under seismic loading, from a global stability perspective.

4.0 Conclusions

As noted above, the "worst-case" scenario sections for the proposed slope and retaining walls greater than 1 m in height were analyzed, and are considered to be stable under static and seismic conditions.

We trust that the current submission meets your immediate requirements.

Best Regards,

Paterson Group Inc.

Deepak Rajendran, EIT

Scott S. Dennis, P.Eng.

Attachments:

- ❐ Figure 1 – Key Plan
- ❐ Figure 2A – Section A-A - Global Stability Analysis Under Static Condition
- ❐ Figure 2B – Section A-A - Global Stability Analysis Under Seismic Condition
- ❐ Figure 2C – Section B-B - Global Stability Analysis Under Static Condition
- ❐ Figure 2D – Section B-B - Global Stability Analysis Under Seismic Condition
- ❐ Figure 2E – Section C-C - Global Stability Analysis Under Static Condition
- ❐ Figure 2F – Section C-C - Global Stability Analysis Under Seismic Condition
- ❐ Drawing PG7100-1 – Site Plan

FIGURE 1

KEY PLAN

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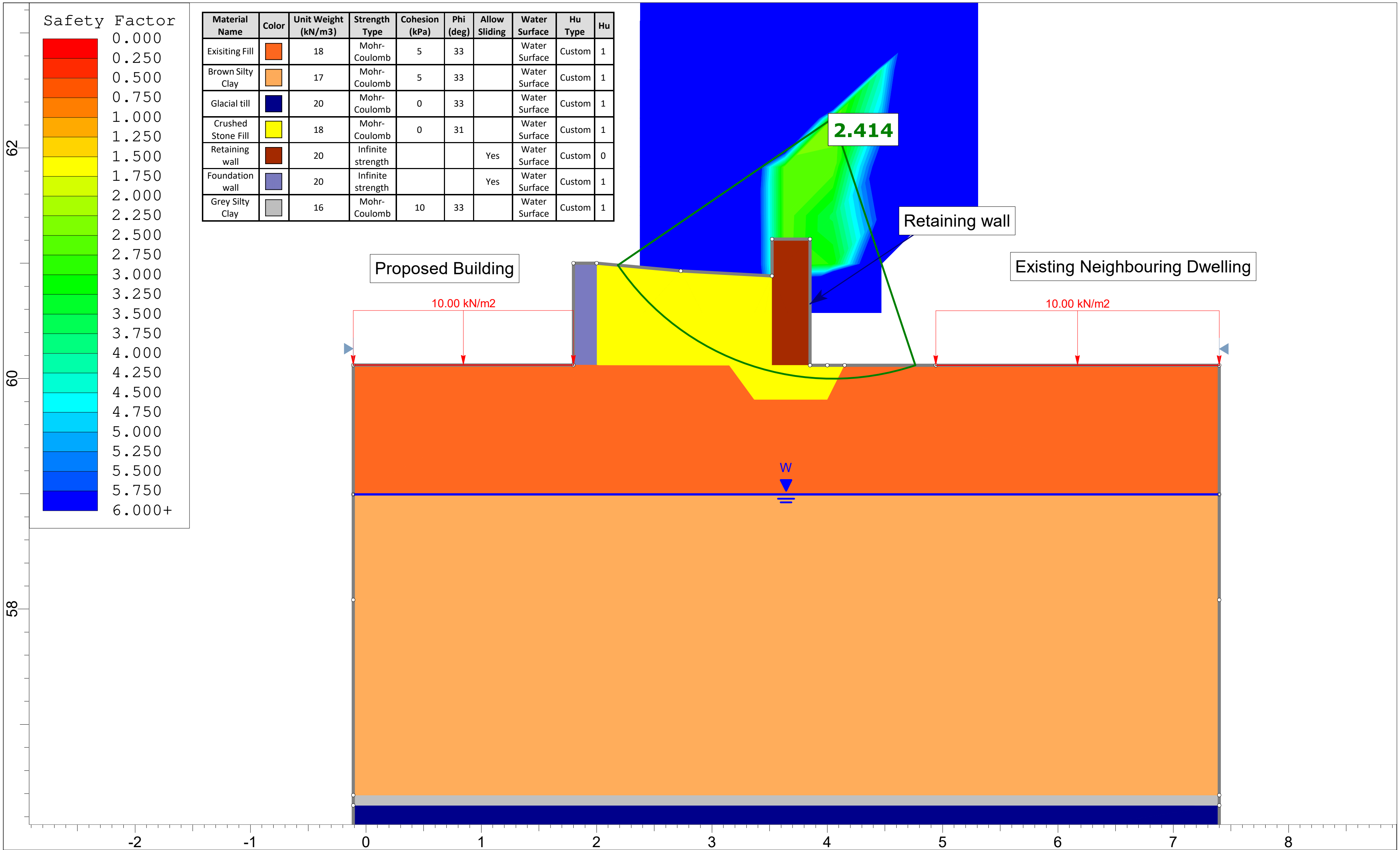

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu
Exisiting Fill		18	Mohr-Coulomb	5	33		Water Surface	Custom	1
Brown Silty Clay		17	Mohr-Coulomb	5	33		Water Surface	Custom	1
Glacial till		20	Mohr-Coulomb	0	33		Water Surface	Custom	1
Crushed Stone Fill		18	Mohr-Coulomb	0	31		Water Surface	Custom	1
Retaining wall		20	Infinite strength			Yes	Water Surface	Custom	0
Foundation wall		20	Infinite strength			Yes	Water Surface	Custom	1
Grey Silty Clay		16	Mohr-Coulomb	10	33		Water Surface	Custom	1

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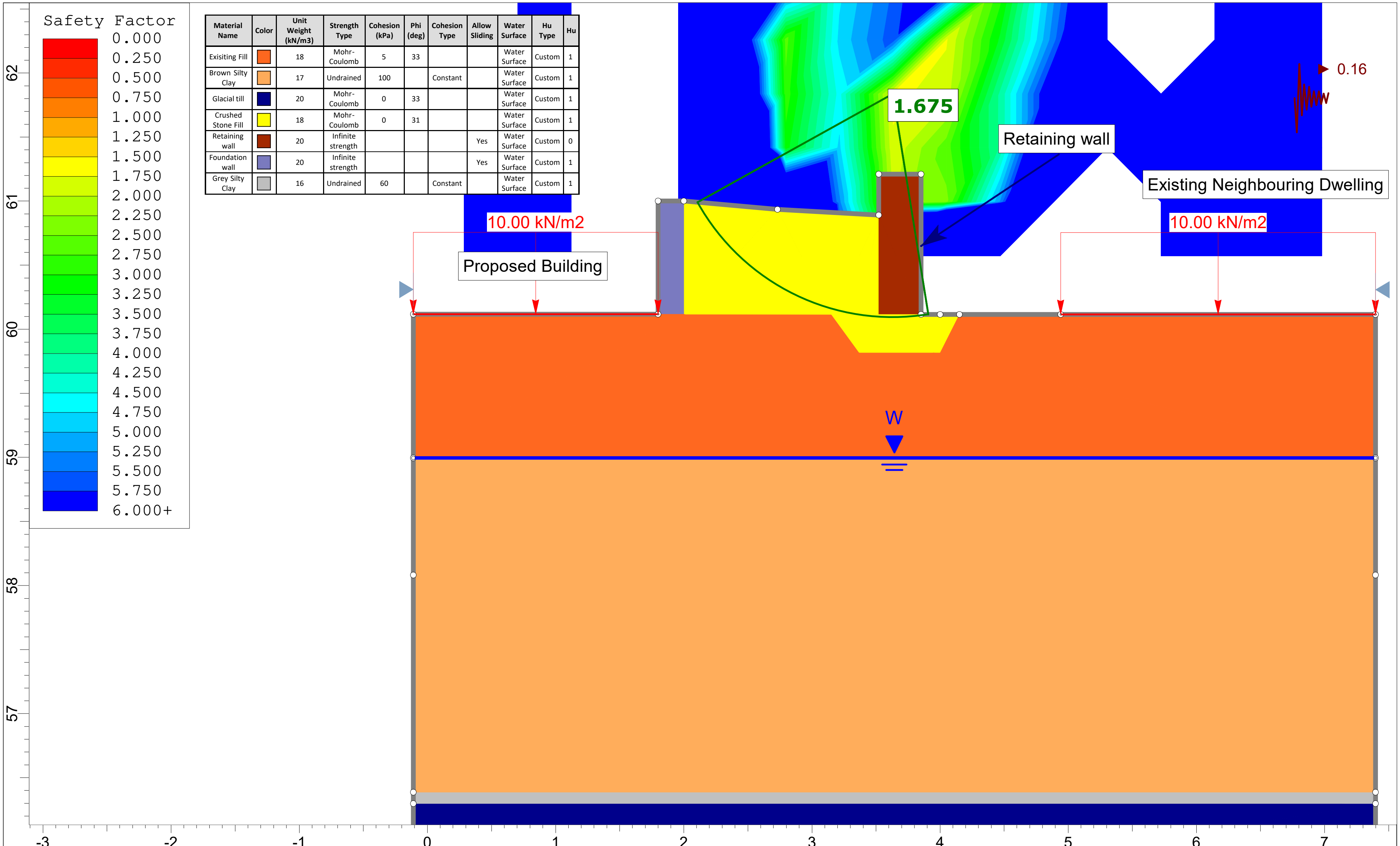
SLIDEINTERPRET 9.025

Project	PG7100 - 83-91 Sweetland Avenue		
Slope Section	A	*Scenario*	Proposed Static Loading
Drawn By	DR	*Company*	Upscale Homes
Date	2025-04-02	*File Name*	Figure 2A



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Allow Sliding	Water Surface	Hu Type	Hu
Exisiting Fill		18	Mohr-Coulomb	5	33			Water Surface	Custom	1
Brown Silty Clay		17	Undrained	100		Constant		Water Surface	Custom	1
Glacial till		20	Mohr-Coulomb	0	33			Water Surface	Custom	1
Crushed Stone Fill		18	Mohr-Coulomb	0	31			Water Surface	Custom	1
Retaining wall		20	Infinite strength				Yes	Water Surface	Custom	0
Foundation wall		20	Infinite strength				Yes	Water Surface	Custom	1
Grey Silty Clay		16	Undrained	60		Constant		Water Surface	Custom	1

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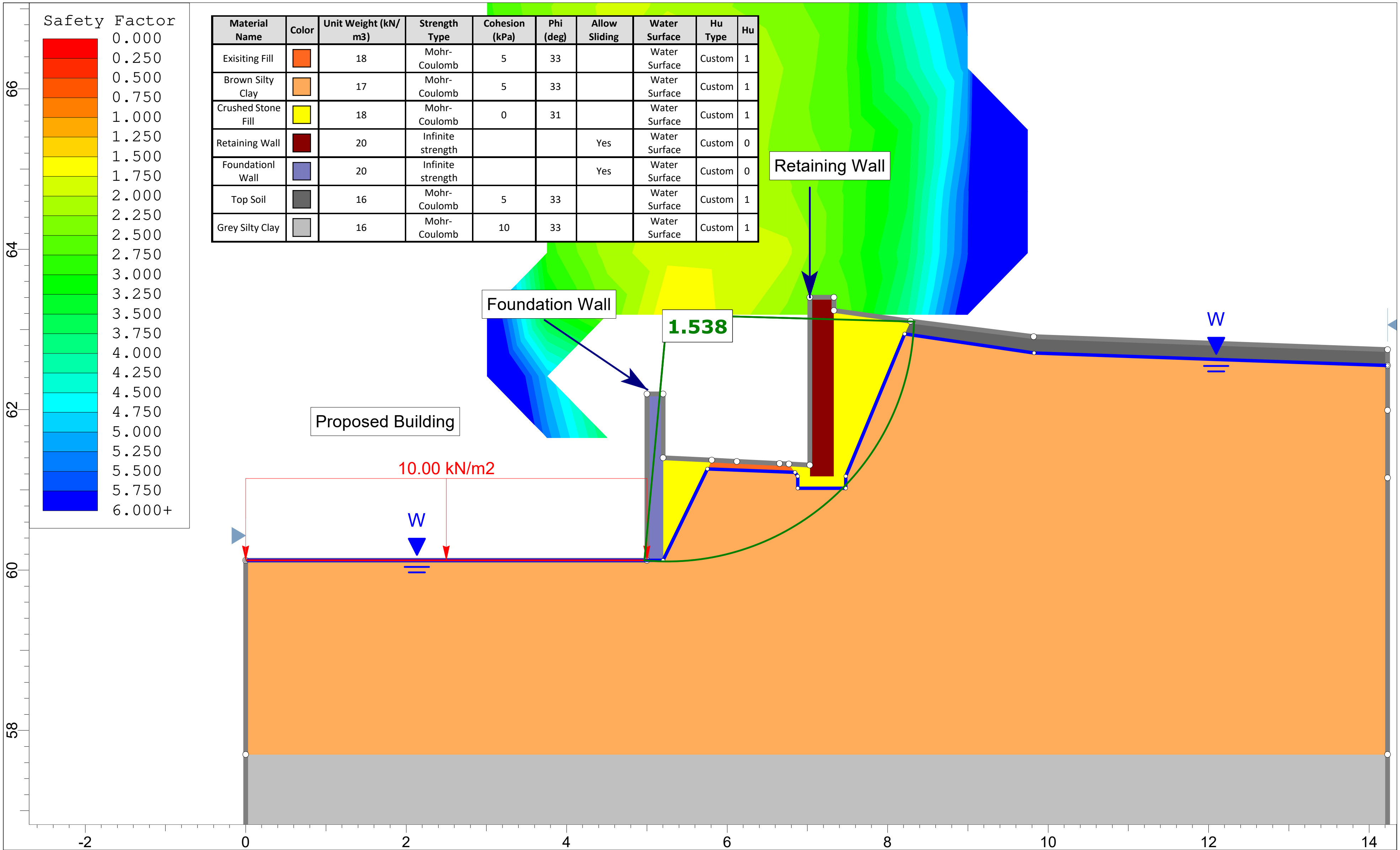
Project	PG7100 - 83-91 Sweetland Avenue		
Slope Section	A	*Scenario*	Proposed Seismic Loading
Drawn By	DR	*Company*	Upscale Homes
Date	2025-04-02	*File Name*	Figure 2B



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu
Exisiting Fill		18	Mohr-Coulomb	5	33		Water Surface	Custom	1
Brown Silty Clay		17	Mohr-Coulomb	5	33		Water Surface	Custom	1
Crushed Stone Fill		18	Mohr-Coulomb	0	31		Water Surface	Custom	1
Retaining Wall		20	Infinite strength			Yes	Water Surface	Custom	0
Foundationl Wall		20	Infinite strength			Yes	Water Surface	Custom	0
Top Soil		16	Mohr-Coulomb	5	33		Water Surface	Custom	1
Grey Silty Clay		16	Mohr-Coulomb	10	33		Water Surface	Custom	1

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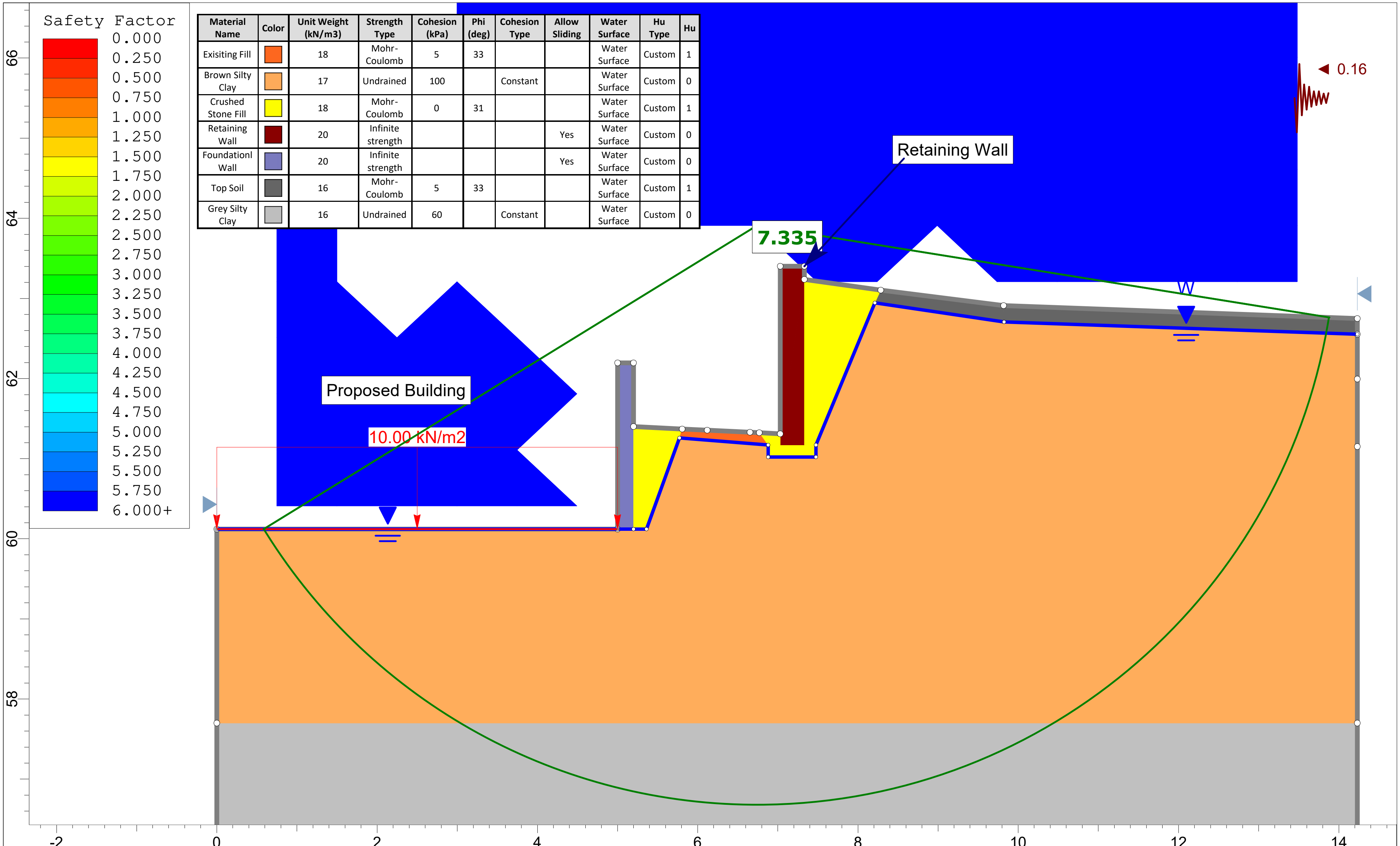
Project	PG7100 - 83-91 Sweetland Avenue		
Slope Section	B	*Scenario*	Proposed Static Loading
Drawn By	DR	*Company*	Upscale Homes
Date	2025-04-02	*File Name*	Figure 2C



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Allow Sliding	Water Surface	Hu Type	Hu
Exisiting Fill		18	Mohr-Coulomb	5	33			Water Surface	Custom	1
Brown Silty Clay		17	Undrained	100		Constant		Water Surface	Custom	0
Crushed Stone Fill		18	Mohr-Coulomb	0	31			Water Surface	Custom	1
Retaining Wall		20	Infinite strength				Yes	Water Surface	Custom	0
Foundationl Wall		20	Infinite strength				Yes	Water Surface	Custom	0
Top Soil		16	Mohr-Coulomb	5	33			Water Surface	Custom	1
Grey Silty Clay		16	Undrained	60		Constant		Water Surface	Custom	0

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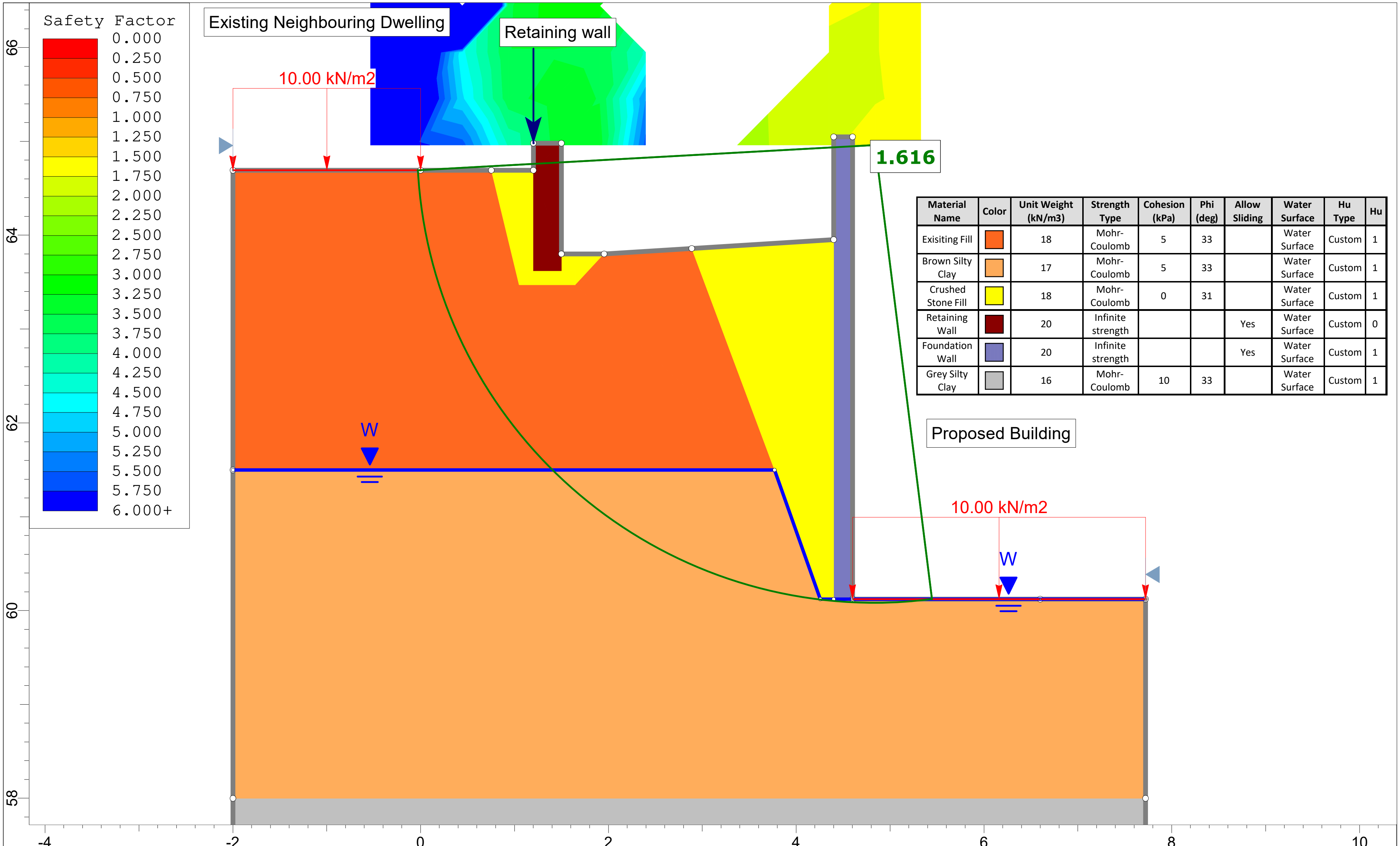
Project	PG7100 - 83-91 Sweetland Avenue		
Slope Section	B	*Scenario*	Proposed Seismic Loading
Drawn By	DR	*Company*	Upscale Homes
Date	2025-04-02	*File Name*	Figure 2D



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu
Exisiting Fill		18	Mohr-Coulomb	5	33		Water Surface	Custom	1
Brown Silty Clay		17	Mohr-Coulomb	5	33		Water Surface	Custom	1
Crushed Stone Fill		18	Mohr-Coulomb	0	31		Water Surface	Custom	1
Retaining Wall		20	Infinite strength			Yes	Water Surface	Custom	0
Foundation Wall		20	Infinite strength			Yes	Water Surface	Custom	1
Grey Silty Clay		16	Mohr-Coulomb	10	33		Water Surface	Custom	1

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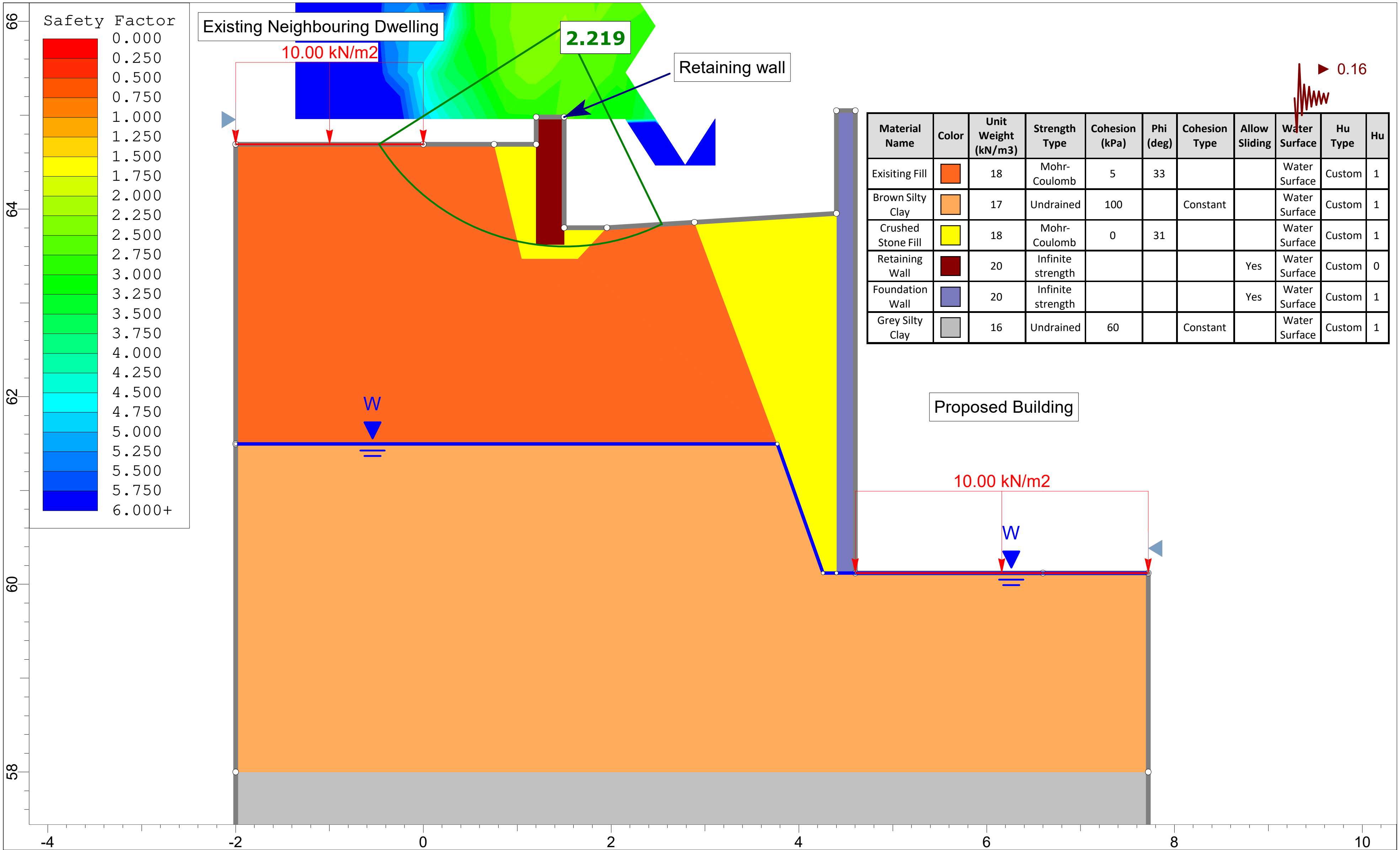
Project	PG7100 - 83-91 Sweetland Avenue		
Slope Section	C	*Scenario*	Proposed Static Loading
Drawn By	DR	*Company*	Upscale Homes
Date	2025-04-02	*File Name*	Figure 2E



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Allow Sliding	Water Surface	Hu Type	Hu
Exisiting Fill		18	Mohr-Coulomb	5	33			Water Surface	Custom	1
Brown Silty Clay		17	Undrained	100		Constant		Water Surface	Custom	1
Crushed Stone Fill		18	Mohr-Coulomb	0	31			Water Surface	Custom	1
Retaining Wall		20	Infinite strength				Yes	Water Surface	Custom	0
Foundation Wall		20	Infinite strength				Yes	Water Surface	Custom	1
Grey Silty Clay		16	Undrained	60		Constant		Water Surface	Custom	1

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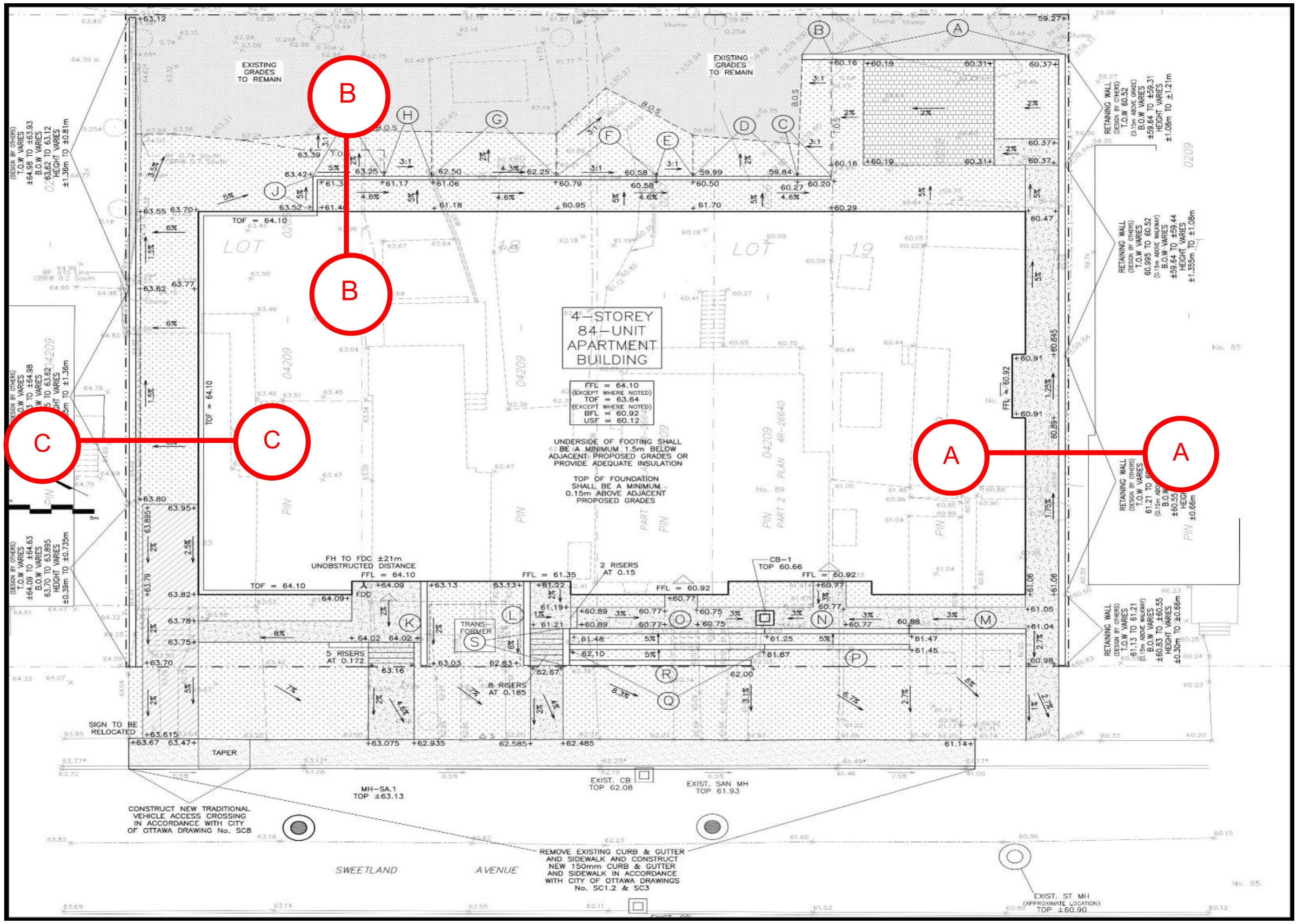
SLIDEINTERPRET 9.025

Project	PG7100 - 83-91 Sweetland Avenue		
Slope Section	C	*Scenario*	Proposed Seismic Loading
Drawn By	DR	*Company*	Upscale Homes
Date	2025-04-02	*File Name*	Figure 2F



DRAWING PG7100-1

SITE PLAN

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